Need to include SPMs, Great Basin

OPERATIONS

Network operations at the ARB are primarily performed by the Air Quality Surveillance Branch (AQSB) of MLD. AQSB duties include the operation of the ARB monitoring sites, monitoring support for the ARB special studies, and general air monitoring support, which includes repair and calibration facilities and the standards laboratory. This section of the TSA report addresses AQSB's general operations, the calibration program, field operations of the AQSB at the ARB operated criteria pollutant monitoring sites, field operations at criteria pollutant monitoring sites operated by the San Joaquin Valley APCD, the Great Basin Unified APCD and the Northern Sierra AQMD, and our review of operations in AQSB's standards laboratory. The standards laboratory performs verifications of ozone and flow rate primary standards, calibrations and certifications of ozone and flow transfer standards, and certification of compressed gas cylinders. These are performed in support of the ARB operations as well as the operations at several local Districts.

On July 30, 2007 EPA interviewed managers and staff of the Air Quality Surveillance Branch (AQSB) providing support to the field monitoring task. The individuals interviewed included Ken Stroud, Chief Air Quality Surveillance Branch, Reginald Smith, Manager Operational Support Section, Eric McDougall, Manager Special Purpose Monitoring Section, Joe Rohr, Instrument Technician Operations Support Section, and Ronald Lewis, Air Pollution Specialist Air Monitoring Central Section. All persons in the Air Quality Surveillance Branch interviewed were very helpful and forthcoming. The AQSB has a well developed framework to support the MLD monitoring task. It was particularly noted that the Operational Support Section includes functions that add significant value to AQSB's monitoring program, both in terms of technical expertise and improved monitoring data quality.

GENERAL FINDINGS

Finding: Field operators do not always document shipping information on their sample report/tracking sheets. See also Lab Finding #

Discussion: Documentation of sample shipping, transport, and relinquishment, maintains sample custody throughout the sampling process, attests that sample were handled properly, and documents by whom they were handled. This information is important if a question about a sample's validity arises.

Recommendation: Ensure that field operators are aware of the importance of documenting shipping information.

Finding: Some ARB MLD monitoring SOPs are outdated and/or incomplete.

Discussion: ARB should develop a schedule for updating all monitoring SOPs and ensure that the SOP's posted are complete and cover all instruments used in the ARB monitoring network

Finding: White out was noted on an MLD air monitoring form.

Discussion: It was noted that white out was used on a form produced by the MLD monitoring group. Changes to official records should not be covered or obliterated. Generally, mistakes should be indicated by a single line crossed out and with an initial and date.

Recommendation: ?

INSTRUMENT CALIBRATION PROGRAM

ARB is responsible for calibrating its own criteria pollutant monitors and offers calibration support to districts if requested. Of the approximately 341 criteria pollutant monitors in the ARB PQAO, ARB calibrates 139 instruments (96 ARB instruments and 45 District instruments). ARB also calibrates some non-criteria pollutant instruments. Of the approximately 97 non-criteria pollutant instruments and 113 meteorological instruments, ARB calibrates its own 39 non-criteria instruments and 37 meteorological stations and calibrates 11 District operated non-criteria instruments and 2 District operated meteorological stations.[1]

Instrument Calibration Program Findings

Finding: ARB MLD does not calibrate monitoring equipment at all PQAO sites.

Discussion: Over the past decade the ARB MLD monitoring sections have reduced calibration support for District sites. Consequently, Districts have established their own instrument calibration procedures independent of the ARB PQO. This practice does not support the existence of a centralized standardization of instrumentation and consequently consistent data quality throughout the PQO.

Recommendation: ?

Finding: Second level review of calibration records and calculations is not routinely done.

Discussion: The senior field technicians are responsible for calibration of the ARB MLD field instruments for their respective monitoring sections (North, South, and Central). These technicians generate calibration records, which are not necessarily reviewed by a

[1] ARB also calibrates 20 Toxics samplers run by the Bay Area AQMD, the South Coast AQMD and the San Diego APCD.

peer or a manager. Second level review is important to ensure consistency and to catch errors made in transcriptions or calculations.

Recommendation: ?

Finding: The lowest ozone calibration point is at a concentration that is above the 8 hour standard.

Discussion: The ARB MLD Air Quality Surveillance Branch calibrates ozone monitors down to 0.09 ppm. This concentration is above the NAAQS of 0.08 ppm. In order to verify linearity around or below the NAAQS ARB should change the low ozone calibration point to at or below 0.08 ppm.

Recommendation: ?

Finding: The calibration technician noted that only 2 gas phase titration points are used to verify the NO2 calibration.

Discussion: 40 CFR Part 50, Appendix F describes the requirements for NO2 calibration. Section 1.5.9.4 states: "Maintaining the same FNO, FO, and FDas in section 1.5.9.1, adjust the ozone generator to obtain several other concentrations of NO2over the NO2range (at least five evenly spaced points across the remaining scale are suggested)." Based on the regulation "several" other NO2 point after the initial must be evaluated.

Recommendation: ARB MLD should include more evaluation points in the NO2 gas phase titration.

Finding: Maintenance and performance verification of zero air scrubbers used for calibrations is not documented.

Discussion: Zero air scrubbers are used in place of certified zero air for instrument calibrations. This is a common practice and acceptable. Because zero air is used to generate the zero point and the calibration mixes it must be treated as a standard. As such, zero air scrubber maintenance and verification must be documented.

Recommendation: ?

FIELD OPERATIONS

During this TSA the EPA audited[2] the operations at 14 stations as summarized in Table 1.

[2] The term audit in this case refers to a review of operations at the monitoring station and an evaluation as to whether the monitoring station meets EPA probe siting criteria in 40 CFR 58, Appendix E. It is not a performance audit of the pollutant measuring instruments.

OPERATING AGENCY	MONITORING STATION
ARB	Stockton - Hazelton Modesto - 14th Street Oildale Visalia Fresno – 1st Street
San Joaquin Valley APCD	Bakersfield – Golden State Highway Corcoran Parlier Tracy Fresno – Clovis
Northern Sierra AQMD	Grass Valley Portola Truckee Quincy

TABLE 1. MONITORING STATIONS EVALUATED
DURING U.S. EPA TSA OF CAL-EPA'S ARB

ARB Monitoring Sites

Five monitoring stations operated by the ARB were evaluated. ARB staff interviewed were Ron Lewis, Dianne Arnold, George Jung, and Patrick Seamus. ARB is to be commended for having an especially competent staff of field operators. During our discussions of operations staff all exhibited an extensive knowledge of instrument operations and the day to day documentation of activities was exemplary. Senior field technicians were very engaged in all operations of their sites. EPA also appreciates the relationship the Air Monitoring Central Section has with local District operators. The invaluable technical support provided to the Districts was very evident.

All ARB monitoring sites evaluated were equipped with manifolds oriented vertically behind the instrument rack. The manifold is cleaned once a year or as needed. Water is used as the cleaning agent. The manifold is conditioned by flooding it with ozone for about an hour, repeated if necessary. The Teflon instrument inlet lines are changed annually. Manifolds are equipped with blowers that provide an air flow rate of between approximately 2.4 lpm and 5 lpm, depending on the station.

The ARB has specific SOPs addressing data acquisition and corrective action procedures. Station operators interviewed were well versed in their duties regarding data validation and how to address corrective actions. Corrective actions are dealt with on a case-by-case basis. If a site instrument fails an annual audit, specific corrective actions are taken based on consultation with senior field operations staff.

The operators are encouraged to document any unusual events in the station log, sample data forms and strip charts. All documentation regarding data editing and validation is reviewed and signed off monthly by the senior field technician before forwarding to the Special Purpose Monitoring and Data Support Section of the Air Quality Surveillance Branch of the Monitoring and Laboratory Division.

All field SOPs are available to operators and while many of them are in the process of being reviewed and revised as necessary, operators generally had a draft copy available. The ARB posts all final SOPs on its website. However the SOPs are generally not controlled copies. While deviations from SOPs are rare, in the event that a deviation from a SOP is necessary, it is documented in the station log after consultation to senior field technicians.

The flow rate of low flow PM instruments is checked bi-weekly, calibrations of low flow samplers is semi-annually. High volume PM sampler flow checks are performed monthly and calibrations semi-annually. Flows are checked at 16.67 lpm for low flow instruments and at 40 scfm for high volume instruments. For gaseous instruments, flow checks are done daily and calibrations are performed semi-annually.

The ARB stations are set up to automatically perform precision and zero checks each day and span checks weekly. Precision checks for ozone, NO2 and SO2 are made at the 0.09 ppm level and 9.0 ppm level for CO. Weekly span checks for ozone, NO2, and SO2 are at 80% of full scale, generally in the area of 0.38 to 0.39 ppm and CO is checked at about 35.0 ppm.

The ARB performs all required level 1 zero and span calibrations for all continuous monitoring equipment and all flow checks made for PM10 and PM2.5 samplers. The ARB has acceptance criteria for zero/span checks set at $\pm$ 10%. All field staff interviewed were aware of the acceptance criteria and they are included in the ARB SOPs. The ARB SOPs also indicate when zero/span adjustments should be made. Zero and span control charts are maintained in an electronic format and are printed each month as part of the data validation process. Zero and span adjustments, when necessary, are only made after precision checks. Charts of precision checks are also produced during the monthly data validation process.

The ARB has a comprehensive mandatory training program for new monitoring staff. Staff are also given the opportunity to attend refresher courses given by the ARB and instrument manufacturers.

Minor instrument repair work is done at the station. If necessary, equipment is sent to the MLD for major repairs. Replacement equipment is sent to the station within a day to replace any instruments taken out of service for repair. Other than standard manufacturer warranties, the ARB does not have any service contracts in place. Station operators indicated that they have an adequate supply of spare parts and consumable supplies to ensure that necessary repairs and maintenance can be performed.

All stations maintain log books to document site visits, preventive maintenance, resolution of operational problems, and corrective actions taken. Logbooks were generally very detailed. The senior monitoring technicians periodically review the logbooks and also note in the logbook when they visit the station. A standard, routine review of logbooks is not performed. Operators archive station logbooks at their main monitoring station or office. Other station records include QC checklists and maintenance sheets which are also archived at the operator's main monitoring station or office. All necessary calibration information is available to the field operators.

The ARB monitoring stations use ESC 8800 data loggers to store data. Data loggers are polled routinely by the ARB central computer. Date is also recorded on a Yokogawa DR-240 strip chart recorder. Particulate matter sampler flow rates are recorded on the sampler QC check sheets. Data loggers can hold up to about 30 days worth of data.

ARB FIELD OPERATION FINDINGS

1) Finding: The trees to the east of the Fresno 1st Street station building are about 15 meters from the inlet probe and PM manual instruments.

Discussion: EPA siting criteria require that trees are at least 10 meters from instrument inlets and at least 20 meters when the trees act as an obstruction. CARB plan to relocate this station to its proposed new site 375 meters to the east southeast will address this finding.

Recommendation: None.

2) Finding: At the Stockton-Hazelton monitoring station, a large tree to the south of the trailer is acting as an obstruction for the gaseous pollutant sample train inlet as well as to the PM10 and PM2.5 samplers. This site does not meet the probe siting criteria in 40 CFR 58, Appendix E.

Discussion: The obstruction caused by this tree has been noted in previous visits to the site. According to Ron Lewis, Lead Air Pollution Specialist, the tree has been trimmed in the past in an attempt to minimize its affect as an obstruction. The PM manual samplers were previously located on the roof of the Health Department Building but were moved when the roof was repaired. Ron believed they could return the PM samplers to the roof. If so, the PM samplers would meet all siting criteria.

The inlet for the gaseous instruments will need to be moved or the tree trimmed significantly in order to meet siting criteria.

Recommendation: Address siting issues by relocating PM samplers to the roof of the Health Department Building. Develop a plan to address the siting of the gaseous instrument inlet probe by either moving inlet probe (this may not be an option since

probe already appears to be as far away from tree as possible), moving the trailer farther from the tree, or by significantly trimming the tree so that it no longer obstructs air flow.

3) Finding: The palm tree northwest of the Visalia monitoring station is within 10 meters of the inlet probe.

Discussion: As stated in 40 CFR 58, Appendix E (Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring), sections 2.4 and 8.2, trees can provide surfaces for O3 or NO2 adsorptions or reductions, surfaces for particulate deposition, and generally obstruct wind flow. EPA understands that removing a tree, especially from a leased site, is not always possible. ARB should perform an analysis of the prevailing wind direction at the Visalia site to determine the direction of the prevailing winds. If the prevailing winds are generally from the northwest, ARB will need to correct this siting issue, either by having the tree trimmed or removed or relocating the site.

Recommendation: Perform an analysis of prevailing wind directions at the Visalia site to help evaluate the impact of the palm tree northwest of the inlet probe and manual samplers.

San Joaquin Valley APCD Monitoring Sites

Five monitoring stations operated by the SJVAPCD were evaluated. Three operators were interviewed, Warren Leleaux, Duane Thompson, and Jaime Contreas. All SJVAPCD sites were all equipped with manifolds oriented vertically behind the station instrument rack. All manifolds were very clean. SJVAPCD procedure is to clean manifolds on an annual or as needed basis. Manifolds are cleaned using water, glass cleaner, and cotton balls. After cleaning and drying manifold is conditioned by either blowing high concentration ozone or pure air through the sample train. The difference seemed to be based on the operator preference. Conditioning is considered complete when ozone levels subsequently drop to normally observed levels.

There are no specific field SOPs available to site operators. Operators rely on instrument operation manuals and ARB SOPs, when available. SJVAPCD operators acknowledged the need for specific instrument and operation SOPs but stated that lack of District monitoring resources made it difficult to address all of the areas in the monitoring program that needed attention.

Corrective actions are dealt with on a case-by-case basis. If a site instrument fails an ARB annual audit, specific corrective actions are taken based on consultation with ARB field operations staff. The SJVAPCD does not have any specific SOPs that address instrument corrective actions. Station operator can note special circumstances on strip chart.

Technicians are well versed in equipment operations. Deviations from understood standard procedures (which are not written) are dealt with on a case by case

basis through consultation with senior equipment operators or with ARB monitoring staff. Any significant issues are noted in station log books.

The operators perform a visual check of manifold flows each time they visit a station by observing a magnehelic gauge connected to the sampling train. Calibration of gaseous instruments is performed every six months. Flow checks of PM10 and PM2.5 continuous analyzers are performed bi-weekly to monthly.

Span concentrations for ozone and NO2 are 0.500 ppm, span concentration for CO is set at approximately 50.0 ppm. Flow checks of continuous PM2.5 (BAM) and PM10 (TEOM) analyzers are made at 16.671 lpm.

Level 1 zero and span calibrations (or calibration checks) are made for all continuous monitoring equipment and flow checks are made for PM10 and PM2.5 samplers. SJVAPCD has acceptance criteria for zero/span checks and these criteria are known to the field operations personnel.

There are no SJVAPCD specific SOPs. The SJVAPCD generally relies on ARB SOPs as well instrument operation manuals. ARB SOPs indicate the acceptance criteria for instrument span checks. ARB SOPs also indicate when zero/span adjustments should be made. As noted above, ARB is currently updating instrument operation SOPs for NO2 and ozone. Previous versions indicated that operators are to perform zero and span checks weekly, with criteria for when adjustments should be made.

The SJVAPCD field operators do not maintain zero and span check control charts. Data logging software can chart QC check data if technician wishes to examine a graphical presentation of QC data. Printing control charts on any set schedule is not performed.

Precision checks are always performed “as is”, on a nightly basis. Zero/span checks are made during working hours. Precision control charts can also be produced by the station data logging software but are not made on a regular basis.

The station operator is responsible for ensuring that zero/span checks are performed. Precision checks for ozone and NO2 are made at 0.100 ppm. Precision checks of CO are made at 10.0 ppm.

SJVAPCD operators receive on the job training, periodic manufacturer training, when offered, and ARB training when available. Minor instrument repair is conducted in the field, major repairs may involve sending instruments to ARB MLD or manufacturer for repair. The SJVAPCD does not have service contracts in place with any manufactures, except where instruments are still under warranty. Routine spare parts are readily available to operators.

There are log books maintained at all stations to document site visits, preventive maintenance, resolution of operational problems and corrective actions taken. The

logbooks were all complete, detailed and up-to-date. The SJVAPCD monitoring supervisor acknowledged the need for reviewing the logbooks periodically but admitted that he did not have the time to do so. While there are no current procedures in place for archiving station logbooks, operators will generally archived used logbooks at their offices. Instrument maintenance sheets and check sheets are the record of QC checks and are archived at the District office or at ARB. Calibration constants are available to field operators and posted at the monitoring stations.

Data produced at monitoring sites are recorded to a PC based data logging system (EMC Station Manager software) and strip chart (Yokogawa DR240 strip chart). The SJVAPCD computer polls stations each half hour and downloads all data. The flow rates of particulate samplers at the station are recorded on the sampler log sheet.

SJVAPCD stations use uninterruptible power supply (UPS) units to provide up to one hour of power in the event of a power outage. The station can come back on line on its own after power outages.

SJVAPCD FIELD OPERATION FINDINGS

4) Finding: The San Joaquin Valley APCD does not have District specific SOPs addressing the operation and maintenance of its air pollution monitoring network.

Discussion: The district staff relies on the CARB SOPs for instrument operations. While this is acceptable in practice, the district should ensure that copies of the SOPs are readily available to all station operators. There is no process in place to ensure this will occur. There is an overall lack of coordination with CARB on the State's oversight role. There are a number of different ways this finding could be addressed.

From a strictly performance perspective, the station operators have a clear knowledge of the monitoring instruments and all required and appropriate QC checks are performed and documented. Yet there are some variations in the QC checks, e.g. concentrations used in span checks for gaseous instruments, manifold cleaning procedures. Having standard operating procedures in place throughout the district would ensure consistent operation of all District sites.

Recommendation: Develop District specific and ARB approved SOPs for all pollutant and meteorological monitoring instruments.

5) Finding: At the Bakersfield – Golden State Highway site, the area surrounding the trailer which houses the monitoring equipment needs to be stabilized.

Discussion: Bakersfield Golden State Highway is one of the higher reading PM10 sites in the San Joaquin Valley District network. EPA regulations at 40 CFR 58, Appendix E, section 8.4 states "Stations should not be located in an unpaved area unless there is vegetative ground cover year round, so that the impact of wind blown dust will be kept to a minimum".

Recommendation: Stabilize the parking area where the Bakersfield Golden State Highway trailer is located.

Northern Sierra AQMD Monitoring Sites

The Northern Sierra Air Quality Management District (NSAQMD) operates a network of ozone and PM monitoring instruments. Four monitoring stations run by the NSAQMD were evaluated. Four operators were interviewed, Joe Fish, the air monitoring manager, George Ozanich, and Ken Walker.

The monitoring manager receives gaseous criteria pollutant data and BAM data from all the sites through telemetry every day. The data is reviewed and hourly values charted. If data seems anomalous, e.g. same value numerous hours in a row or very high/low points, the monitoring manager checks on the instrument or contacts the station operator. If it is determined that a particular instrument is malfunctioning the monitoring manager or the station operator troubleshoots the problem, attempts to fix it, and then calibrates the instrument if necessary. If necessary ARB is contacted for repair support.

Operators keep track of special events or anomalies for continuous instruments in a monthly report sheet and also document issue for senior air monitoring staff. Any special events or anomalies for FRM PM2.5 is recorded on the Chain of Custody sheet and sent to CARB with the filter. Logbooks are not utilized.

Northern Sierra AQMD uses the ARB SOPs. Hardcopies of the SOPs are kept at the Grass Valley office/site but not at any other sites. Site operators have the instrument manuals but not the SOPs. The SOPs are not controlled copies.

There are deviations from the ARB SOPs. For example, NSAQMD uses 5% as an action level for zero/span checks but this deviation, while known to NSAQMD staff, is not explicitly documented anywhere.

Flow checks are performed by station operator once per month. Zero/span checks are done manually once/week, using a span concentration of 0.100 ppm. Multi-point calibrations are done at least once per year by the monitoring manager. Calibrations of ozone instruments are generally performed just before the ozone season, however they are performed whenever necessary, e.g. after instrument repairs or relocations. These are documented on multi-calibration sheets and stored in a binder in the Grass Valley office. NSAQMD sends its calibration ozone instrument to ARB once a year for certification. The ARB is supposed to do flow audits on PM instruments once every six months but in reality the frequency is closer to once per year. NSAQMD's monitoring manager also stated that CARB is not doing through-the-probe audits, rather they introduce audit gases directly to the ozone instruments.

NSAQMD acceptance criteria for span checks is ± 5%. This criteria is well known to the station operators, but are not documented in any SOPs. The NSAQMD

does maintain zero and span check control charts and makes any necessary zero and span adjustments made after precision checks. Precision check control charts are not maintained.

While the monitoring manager has received extensive training on his own, there is no formal training program for NSAQMD staff. Station operators receive on the job training.

Standard logbooks are not used by NSAQMD. For ozone, the monitoring manager keeps an electronic file for each site that contains all hourly ozone data, operator comments, precision check dates, and other relevant station information, e.g. missing data, instrument operation, exceptional events. At the end of each month the monitoring manager prints out all electronic information and stores the hardcopies in a binder. These binders are kept at the district office in Grass Valley. The monitoring manager also keeps a work log in a binder with information on repairs, equipment, etc, as well as data reporting sheets (when data was submitted) and multi-calibration sheets. This information is also kept at the Grass Valley office. Station operators also keep their own records, though the records kept are at the discretion of the operator.

For PM, the monitoring manager's log will indicate when he does flow checks but it this information is not reliably recorded. All other information for the PM samplers is written on the Chain of Custody sheets and sent to the ARB. NSAQMD does not retain these records.

QC and maintenance sheets are kept in binders at Grass Valley office as are multi-point calibration results. The results of these calibrations are available to the Grass Valley operator but not readily available to the other operators.

Automated instrument outputs are telemetered to the District office. The monitoring manager reviews the ozone data and then submits these data directly to AQS with no additional QA checks. The monitoring manager also handles all continuous PM2.5 data. The chain of custody sheets and associated PM filters are sent to the ARB where the filters are weighed. All further data review and data input to AQS is handled by the ARB. The ARB does not report back on PM issues to NSAQMD for many months so there is not opportunity for makeups or to fix problems immediately.

NSAQMD does not utilize strip chart backup for its ozone and continuous PM instruments. Flow rates of particulate samplers are recorded on the chain of custody sheet with each sample. There are no data recovery capabilities in the event of power outages.

NSAQMD FIELD OPERATION FINDINGS

6) Finding: There are trees within 20 m of monitors.

Discussion: Siting requirements state that trees should be >20 m from ozone inlet (40 CFR 58, appendix E). At the Grass Valley site, there is a tree within 4 m of the ozone inlet. At the Quincy site there is a group of trees 10-12 m from ozone, PM2.5, and PM10 instruments.

Recommendation: The tree should be trimmed so that it is not within 20 m of the instruments.

7) Finding: NSAQMD Record-keeping needs to be more rigorous.

Discussion: NSAQMD has no record keeping standard operating procedures. Pollutant instrument information is kept in an electronic format and periodically printed as hardcopies and stored in a binder. Record keeping by individual operators is not consistent and seems to be at the operator's discretion. No station logbooks are maintained. No records for manual PM sampling are maintained.

Recommendation: NSAQMD should develop a SOP for record keeping that includes procedures for utilizing station logbooks, maintaining other necessary records of instrument operations (e.g. QC and maintenance check sheets), provides for regular management review of records, and suitable archiving procedures to ensure the security of these records.

8) Finding: Northern Sierra AQMD experiences significant data gaps because their ozone pumps fail and they don't have spare pumps. They either have to rebuild them or order a new one.

Discussion: 40 CFR 50.11 requires hourly data that are at least 75% complete. To ensure that this requirement is met, prolonged instrument down-time should be avoided, if at all possible.

Recommendation: NSAQMD should have at least one spare ozone pump to avoid unnecessary loss of data.

9) Finding: NSAQMD uses CARB SOPs but there are deviations that are not documented.

Discussion: NSAQMD has modified some of the practices in the CARB SOPs but these deviations are not documented. For example, NSAQMD uses 5% as an action level for zero/span checks for ozone. CARB uses 10% as an action level. While it is commendable that the District uses such stringent acceptance criteria, since they are part of the ARB PQAO they should request approval from ARB to use this tighter criteria.

Recommendation: NSAQMD should either follow the SOPs that have been adopted (i.e., CARB) or modify the SOPs to reflect their practices and get approval from CARB. CARB should ensure that all agencies within their PQAO are following appropriate SOPs.

10) Finding: Audits of NSAQMD instruments performed by CARB do not conform to CFR requirements.

Discussion: Flow audits for PM instruments should occur every 6 months but the schedule has been closer to once/year. For example, the two most recent PM flow checks performed by the ARB were listed by the NSAQMD monitoring manager as occurring on 8/8/2006 and 6/4/2007.

Recommendation: CARB flow checks should be scheduled for every 6 months for PM instruments. The ozone audit should be done through-the-probe.

11) Finding: ARB does not perform through the probe audits of NSAQMD ozone monitors.

Discussion: While ARB performs ozone audits at the required frequency, the NSAQMD monitoring manager noted the last two audits as occurring on 6/26/2006 and 6/4/2007, they are not performing through-the-probe audits. The NSAQMD monitoring manager stated that the audit gas was introduced directly into the ozone instruments and not through the sampling train. There was no explanation for this revised procedure/

Recommendation: ARB auditors should document why they are not performing through-the-probe audits at NSAQMD ozone sites. The NSAQMD monitoring manager should be informed as to why this deviation from normal procedure is necessary.

12) Finding: Site operators have instrument manuals but not SOPs. SOPs are only kept at Grass Valley and are not kept at field stations.

Discussion: SOPs detail the work procedures that are to be conducted or followed within an organization. SOPs document the way activities are to be performed to ensure consistent conformance to technical and quality system requirements and to support data quality. SOPs are intended to be specific to the organization or facility whose activities are described and assist that organization to maintain their quality control and quality assurance processes and ensure compliance with governmental regulations. Well-written SOPs can also serve as training materials and as references for operators, particularly if they are updated regularly (i.e., recommended every three years). SOPs should be distributed in a manner that ensures that only the most recent versions are used and retains historical SOP revisions (these are sometimes called “controlled-copies”). Further guidance on developing SOPs can be found in the EPA guidance document "Guidance for Preparing Standard Operating Procedures", EPA/240/B-01/004, March 2001. Deviations and changes from SOPs should be dated, documented, and kept in a bound or electronic document routinely accessed by and accessible to all staff.

Recommendation: NSAQMD should either follow CARB SOPs or make changes to the SOPs that reflect actual practices and get approval from CARB.

13) Finding: There is no feedback from the ARB on outcome of PM filters. See also Laboratory Finding #

Discussion: The chain of custody sheets and PM filters are sent from local Disricts to the ARB, where all subsequent sample handling and data reporting occurs. The ARB does not report back to Districts for many months so there is no opportunity for make-up sampling runs or to address problems in a timely manner. In the case of exceedance values and PM10 samplers running on a one in six day schedule, Districts need to promptly know when an exceedance of the 24 hour NAAQS occurs so that they have the option of increasing the PM10 sampling frequency to avoid having a single exceedance represent a violation of the NAAQS.

Recommendation: Immediately report filter results when they indicate a problem or an exceedance.

14) Finding: The ARB site survey report was not accurate.

Discussion: Inaccuracies noted on the ARB audit sheet for Grass Valley include:
- A tree within 4 m of ozone inlet
- Ozone calibration listed as not current but then was not listed as an action item.
- BAM – the audit report doesn't specify whether the BAM is PM10 or PM2.5. The BAM at Grass Valley is measuring PM2.5 but the purpose listed in the audit sheet is SLAMS. The BAM is not a FEM approved method for PM2.5.
- The logbook at Portola was listed as up to date. I was told there is no logbook.

Recommendation: CARB should review siting criteria and information on site survey report during audits.

Great Basin Unified APCD Monitoring Sites

TO BE INSERTED

GBUAPCD FIELD OPERATION FINDINGS

Standards Laboratory

The MLD's Standards Laboratory is part of the Air Quality Surveillance Branch. EPA staff evaluated the Standards Laboratory's primary pollutant operations on June 26 and its operations involving the verification of flow measurement devices on August 2, 2007. Individuals interviewed during the audit were Brian Spreadborough and Robert Russell. Mr. Spreadborough leads the ozone primary and transfer standards lab. Mr. Robert Russell leads the primary and transfer standard laboratory for certification and verification of gaseous criteria pollutants, particulate matter, toxic air contaminants and hydrocarbon pollutants. Mr. Russell and Mr. Spreadborough can perform one another's respective responsibilities. They also oversee two student interns Trisha San Juan and Nick Barker who are called to perform flow calibrations as needed based on workload.

Both Mr. Russell and Mr. Spreadborough perform a final check of results of each others work before they are released. Hard copy and electronic records of the calibrations and verifications are maintained in the Standards Laboratory.

The Standards Laboratory performs verifications of ozone and flow rate primary standards, calibrations and certifications of ozone and flow transfer standards, and certification of compressed gas cylinders. NIST traceable standard and certified reference materials are used to certify primary and transfer flow standards for the ARB and Districts which submit their standards for certification and verification. Traceability is defined in 40CFR Parts 50 and 58 as meaning ". . . that a local standard has been compared and certified, either directly or via not more than one intermediate standard, to a primary standard such as a National Institute of Standards and Technology Standard Reference Material (NIST SRM or a US EPA/NIST-approved Certified Reference Material (CRM). The Standards Laboratory performs calibration and certification for gaseous criteria pollutants and particulate matter for the following districts:

> Bay Area, Great Basin, Lake, Mendocino, Monterey, Northern Sonoma, Placer, Sacramento, San Diego, San Luis Obispo, Santa Barbara, Shasta, Siskiyou, Tehama, and Ventura and Yolo Counties.

The flow standards are received by the Standards Laboratory either directly (hand carried in), by mail, or by courier. The standards are signed in, certification or calibration performed on a first come, first served basis with a turnaround time of up to three weeks. The following must be satisfied for calibration, certification, or verification:

Ozone

Certification of transfer standards requires six acceptable comparisons against the SRP. Each comparison must have a correlation coefficient of 0.9999 or greater, each slope must be within 5 percent of the expected value, and each intercept must be less than 3 ppb ozone. A certification is valid if the six most recent comparisons have a Relative Standard Deviation of less than 1.5% for the slope and a Full Scale Relative Standard Deviation less than 0.5 percent for the intercept. For recertifications, the current comparison's slope must be within 1 percent of the most recent comparison's slope, otherwise, another comparison must be performed to verify the change. The certified slope and intercept is the average of each of the six comparisons and should be used by the client to correct or adjust the instrument's displayed ozone concentration. EPA requires reproducibility of 2 times the coefficient of variation (40 CFR Part 50, App B, Section 7.8.3)

Verification of an ozone primary standard consists of one acceptable comparison against a primary standard reference photometer (SRP) that is maintained by the ARB. For the verification to be valid, the linear regression must have a correlation coefficient of 0.9999 or greater, the slope must be within 3 percent of the expected value, and the intercept must be less than 3 parts per billion (ppb) ozone.

Low-Volume Flows (0.005 to 50 lpm)

Prior to calibrating or verifying the guest device under test (GDUT) instrument, a calibration check is performed by the Standards Laboratory to ensure the primary flow standard instrument is within the ARB's specifications. These checks include: leak check, tare value is stable (zeroed), and temperature. Upon satisfactory check, they commence with the calibration or verification of the GDUT and electronically capture the output on the display panel of the GDUT. Results are read directly off the GDUT display panel and entered into an electronic database system (DBASE). Access to the database system is password protected and limited to Mr. Russell and Mr. Spreadborough. It was noted that DBASE would soon be updated.

A calibration consists of one comparison against a primary flow calibrator. The comparison must have a linear regression with a correlation coefficient of 0.9999 or greater. The derived slope and intercept should be used by the client to correct or adjust the instrument's displayed flow rate.

Certifications require four consecutive comparisons against a primary flow calibrator. It is preferred to alternate primary flow calibrators for each comparison. Each comparison must have a linear regression with a correlation coefficient of 0.9999 or greater. A certification or recertification is valid if the four most recent comparisons have a RSD less than 1 percent for the slope and FRSD less than 1 percent for the intercept. For recertification's, the current comparison's slope must be within 1 percent of the most recent comparison's slope, otherwise, another comparison must be performed to verify the change. The certified slope and intercept is the average of each for the four comparisons and should be used by the client to correct or adjust the instrument's displayed flow rate.

Verifications consists of one multi-point comparison against one of two primary flow calibrators: Molbox/MolblocA or Molbox/MolblocB Flow Calibrator. For a verification to be valid, the linear regression of the comparison must have a correlation coefficient of 0.9999 or greater, the slope must be within 3 percent of the expected value, and the intercept must be less than 1 percent (full scale) from the calibrator's intercept

High Volume Flows (566 to 2,360 lpm) for Particulate Matter

Certifications of high volume flows are performed with a Rootsmeter certified every two years by the original manufacturer. A certification or recertification is valid if the two most recent comparisons have a RSD less than 0.7 percent for the slope and intercept. In order for each comparison to be valid, all the points in the assay must be within 2 percent of the regression line. The certified slope and intercept is the average of each for the two comparisons. A slope and intercept is provided to determine both the Actual Flow (Qa) and Standard Flow (Qstd). EPA's acceptance criteria is +/-2% of NIST traceable standard, 40 CFR Part 50, App. L, Section 9.1, 9.2

The flow standard for particulate matter is recalibrated in house with a NIST certified primary standard #7 provided by US EPA. For a calibration to be satisfactory, the assay must have a correlation coefficient of better than 0.9999. Slope RSD % compared to the previous assay must be less than 0.7 %. Intercept FRSD % compared to the previous assay must be less than 0.7 %. Results are discussed with EPA and upon satisfactory determination, a recertification is issued to ARB.

In-house Certification checks.

Gaseous flow evaluations occur on a quarterly basis by the Standards Laboratory. These evaluations are referenced to a primary NIST traceable flow device. Eight molbox performance are checked using five different flow rates comprising the full calibration scale. The molbox performance is also cross checked against each other on an alternating cycle. The results from each level tested are pooled and averaged with prior three quarterly calibrations and correlation coefficient (CC) determined. For flow transfer standards, the relative standard deviation for the slope must be less than 1 percent and the intercept divided by full scale reading x 100 percent must be less than 1 percent for the last four calibrations.

The criteria used by the Standards Lab is tighter than that required by EPA in 40 CFR Part 50 (varies between 1 and 2% for flow controllers and meters, respectively). Any deviation from criteria are monitored and retested on the following day. If a shift exists and does not meet criteria, the primary standard is sent for recalibration and recertification by DH Instruments. A significant shift was determined in November of 2004 on two molboxes where the flow standard was sent to DH Instruments for recalibration. Upon return the instrument, a verification check was performed. The instrument was still found out of criteria and resubmitted to DH Instruments. The Standard Laboratory's verification check of DH Instruments calibration for this period was not available for review. It was noted by the Standard Laboratory manager that this would be prepared in the future.

The molbox flow transfer standards are sent out to DH Instruments on an annual or more frequent basis when degradation in instrument performance is observed as required in 40 CFR Part 50, Appendix L, Section 9.2.2.

15) Finding: There is no corrective action procedure in place to notify Quality Assurance or Field Audit staff of failure i.e., potential rejection of data from period prior to calibration check taking place when transfer and flow standards fail calibration.

Discussion: The Standards Laboratory notifies the guest (ARB site manager or District) of failure, and that the failure must be remedied, prior to resubmission of standards. The same notice can be provided Quality Assurance and Field Audit staff to apprise them of the failure, potential impact on data collected prior to recalibration, and for monitoring during audits.

Recommendation: A reporting mechanism should be developed to communicate calibration/verification failures to Quality Assurance and Field Audit staff. Similarly QAS should develop procedures on how to evaluate and address data produced prior to the failures determined.

16) Finding: The thermometer in the Standards Laboratory needs to be recalibrated against a NIST traceable standard.

Discussion: While the calibration certification noted that the thermometer once calibrated does not require recalibration, calibration is recommended to occur on a scheduled frequency e.g., annually. Annual calibration is suggested as this is the required frequency for standards. This is to ensure temperature recordings are accurate and do not lead to questioning on the validity of calibrations, certifications, or verifications performed by the Standards Laboratory that are dependent on temperature.

Recommended: Recalibrate thermometer against a NIST traceable standard on an annual basis when other instrumentation is recertified or recalibrated.

17) Finding: There is insufficient documentation in logbook entries in the ozone Standards Laboratory.

Discussion: For traceability and the ability to recreate events, accurate and complete recording of logbook entries is essential. Some logbook entries were incomplete. For example, there is also no record of zero and span except on chart recorder. Documentation should include analyzer identification, date, calibration standard used and its traceability, identification of calibration equipment used, the individual conducting the span calibration, the unadjusted zero and drift span responses, the adjusted zero and span responses, calibration equation(s) (and curve, if prepared). Quality control charts are an excellent addition and form of documentation to graphically record and track calibration results, which was being performed (see comment 5 below). Zero and span documentation should be maintained both in a central file and at the monitoring site. Instrument certification and maintenance log also contain sparse information, no identification of party making the entry from 1989 to present.

Recommendation: Complete and full descriptions of what was performed, captured, by whom, when, etc. should be documented in log books or log sheets.

18) Finding: Calibration of the primary flow standards brought in by ARB staff or District does not always occur on an annual basis. There is no tracking by the Standard Laboratory to ensure District or ARB flow standards are annually recertified.

Discussion: 40 CFR Part 50, Appendix L, Section 9.2.2 and Volume II, Part 1, QA Handbook for Air Pollution Measurement Systems, Ambient Air Quality Monitoring Program, Quality System Development, EPA 454/R-98-004, August 1998 requires that the primary flow standard minimally be calibration annually. For example, for the Air Monitoring North site, the graseby variable orifice, bar code 107376, sn 5346 was

brought in for certification on 02/25/04, 01/19/06 and 07/18/07. This instrument does not meet regulatory or handbook requirement.

Recommendation: ARB Field staff and Districts need to more cognizant of 40 CFR Part 50 recert/recal requirements to ensure they are not missed. This step should be included in a Standard Operating Procedure (SOP) for calibrations to ensure they occur on an annual or more frequent basis (where deviations occur before scheduled recalibration).

A method for tracking the submission of flow standards for recertification and calibration should be developed to ensure the standards are timely recertified or recalibrated and are producing defensible data. Consideration should be given to automated computer generated reminders to ARB sites and Districts.

19) Finding: Manometers were not calibrated separately from transfer standards.

Discussion: Manometers are often changed out, and separated from the transfer standard that was sent in for certification. As this appears to be common practice, manometers should be calibrated separately to ensure that if they are "exchanged" out, there is a record to demonstrate that the manometer, despite being changed out satisfy certification criteria.

Recommendation: Manometers should be calibrated separately from transfer standard.

20) Finding: The control charts for Hi Vol flow standard was above two standard deviations from approximately September 2005 and reached three standard deviation at approximately January 2006, before corrective measures were taken to bring it back into control.

Discussion: It is commendable the Standards Laboratory produces control charts to evaluate its own performance. As ARB is expected to establish and maintain "the standard" for use in calibrating Districts and ARB-MLD flow standards, the Standards Laboratory should try to maintain its primary standard as close to one standard deviation, where possible.

Recommendation: Continue to produce control charts to self assess and monitor performance. Upon reaching 2 standard deviations, checks should be performed as to why this is occurring.

21) Finding: Standards Lab High Volume Orifice Calibration Work Sheet is not always filled out completely. Similarly logbooks, the party performing calibration for the ozone standards is not recorded.

Discussion: To enable calibration tracking, the worksheet should be completed with roots meter used to perform calibration, and the party checked by.

Recommendation: All Standard Laboratory worksheet entries should be completed, including identification of the party making the entries.

22) Finding: Calibration records from DH Instruments, Inc. are not always opened upon receipt.

Discussion: Some records from 2006 (calibration report No. 48879, October 3, 2006 and 47162, July 12, 2006) indicate that the primary standard was out of tolerance. Results of recalibration should be opened and reviewed upon receipt. This is important to do as out of tolerance determinations may impact District and ARB generated data that has been submitted to AIRS. Notice should be issued to the impacted Districts and ARB site managers to communicate the out of tolerance situation found and its potential impact on data (whether data should be rejected, corrected; and from what point in time). Events where DH Instruments' evaluation reviewed indicated out of tolerance situations, DH concluded there was no expected impact on data quality.

Note in the introduction that Standards Laboratory personnel perform calibration checks on a quarterly basis. They also verify the primary standard meets ARB criteria after recalibrated by DH Instruments. These are both excellent practices to minimize loss of data. Records of the checks performed after recalibrated by DH Instruments were not available for review and would be maintained in the future (see comment 9).

Recommendation: Open and review calibration results from DH Instruments. Develop procedures to issue data impact notices, as appropriate.

23) Finding: The Standard Laboratory does not maintain calibration verification records it performed on instruments recalibrated by DH Instruments.

Discussion: One of the standards was found out of criteria by the Standard Laboratory during its routine performance checks and was sent to DH Instruments for recalibration at least two times before the standard was found in criteria by ARB-MLD. Rechecking upon receipt is excellent practice by the Standards Laboratory; they would not have otherwise caught the deviation from criteria. Records to demonstrate the instrument was tested for meeting calibration criteria upon return to the Standards Laboratory should be maintained.

Recommendation: Verification of calibration should be performed and records maintained.

24) Finding: There is no backup to the stand alone DBASE database server that maintains records from results of calibrations performed of District and ARB-MLD sites.

Discussion: The database may be subject to failure as the software used to store records from calibration is DBASE. DBASE is no longer in production and not supported by the manufacturer. Currently, despite the system being only accessible to Standard Laboratory staff, DBASE failure or corruption of the database would require

Standard Laboratory staff to laboriously go through each hard copy record and compare it against database records to ensure the electronic record is present and accurate. ARB-MLD noted that an updated software to maintain calibration records for the Districts and ARB would be obtained to avoid any potential DBASE failure.

Any database maintained at the regulatory level of ARB should have a automated overnight backup system, that is secure from corruption and access other than those authorized.

Recommendation: A back-up system needs to be developed along with standard operating procedures (SOPs) to implement it. While the backup system can be maintained on site, it is preferred that it be off-site in a secure, safe location, potentially in ADAM.

25) Finding: Hard copy records of changes made to DBASE electronic data (see comment 10 above) is not easily accessible.

Discussion: The database that contains results from calibration of District and ARB-MLD flow standards is capable of recording changes, however, the hard copy from which the change was made was not accessible at the time of review. The auditor was informed that changes rarely occurred, and that the records could be found if necessary. The reviewer sought to verify that the electronic change was included in the hard copy record, and also to see the original data.

Recommendation: Any changes to electronic data should kept in a bound logbook, and traceable to the hard copy data e.g., with a serial number or date of analyses and project.

Finding MP 21 **Operations/Calibrations**

Finding: Second level review of calibration records and calculations is not routinely done.

Discussion: The senior field technicians are responsible for calibration of the ARB MLD field instruments for their respective monitoring sections (North, South, and Central). These technicians generate calibration records, which are not necessarily reviewed by a peer or a manager. Second level review is important to ensure consistency and to catch errors made in transcriptions or calculations.

Finding MP 23 **Operations/Calibrations**

Finding: The lowest ozone calibration point is at a concentration that is above the 8 hour standard.

Discussion: The ARB MLD Air Quality Surveillance Branch calibrates ozone monitors down to 0.09 ppm. This concentration is above the NAAQS of 0.08 ppm. In order to verify linearity around or below the NAAQS ARB should change the low ozone calibration point to at or below 0.08 ppm.

Finding MP 24 **Operations/Calibrations**

Findng: The calibration technician noted that only 2 gas phase titration points are used to verify the NO2 calibration.

Discussion: 40 CFR Part 50, Appendix F describes the requirements for NO2 calibration. Section 1.5.9.4 states: "Maintaining the same FNO, FO, and FDas in section 1.5.9.1, adjust the ozone generator to obtain several other concentrations of NO2over the NO2range (at least five evenly spaced points across the remaining scale are suggested)." Based on the regulation "several" other NO2 point after the initial must be evaluated.

Recommendation: ARB MLD should include more evaluation points in the NO2 gas phase titration.

Finding MP 25 **Operations/Calibrations**

Finding: Maintenance and performance verification of zero air scrubbers used for calibrations is not documented.

Discussion: Zero air scrubbers are used in place of certified zero air for instrument calibrations. This is a common practice and acceptable. Because zero air is used to generate the zero point and the calibration mixes it must be treated as a standard. As such, zero air scrubber maintenance and verification must be documented.